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Development of an Enlarged Abacus

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DEVELOPMENT OF AN ENLARGED ABACUS

Roger Huff

At present there exists a variety of devices visually handicapped child consumers may use to perform mathematical computations. One of the most generally used devices for performing computational activity is the Cranmer abacus (Lewis, 1970). Since 1964 the Cranmer abacus has been a popular device for performing computational tasks but there is no empirical evidence to suggest that the Cranmer device is being widely used at the primary level for computational activity (Brothers, 1971).

The need for an enlarged abacus was defined in a recommendation from the Institute on Instructional Materials Development in Mathematics for the Visually Handicapped. These educators recommended the design of an abacus one-third larger than the Cranmer abacus (Franks, 1970). The large abacus was suggested for use by young visually handicapped child consumers, and those who lack the manipulative skill required for easy manipulation of the smaller device. It was also noted that the enlarged abacus may be beneficial to the adult blind who have difficulty with manipulation and tactile discrimination.

Introducing an enlarged abacus at the primary level may act as a catalyst to promote increased computational activity with the abacus at earlier levels in the education of the visually handicapped. Lewis has noted a trend in providing initial instruction with the Cranmer abacus at the third grade level (Lewis, 1970). Introducing an

enlarged abacus at very early grade levels will provide another educational aid which may assist a portion of the visually handicapped population in performing mathematical computational tasks.

Materials Development Procedure

A prototype of an enlarged abacus was constructed similar in design to the Cranmer abacus. The enlarged device measured approximately $4 \frac{3}{8}$ inches X 8 inches with thirteen columns of one-half inch beads. Unit markings on the enlarged prototype were identical to the Cranmer device. When face validity was obtained by educational researchers regarding construction and design of the prototype, an evaluation procedure was planned for purposes of recording the reactions of educators to the device.

Evaluation

An assessment instrument was developed in the form of a questionnaire which requested responses regarding the instructional effectiveness of the enlarged abacus, urged suggestions for improvement of the design of the prototype, and asked each educator to indicate if, in his opinion, there was sufficient need to warrant production of an enlarged device. Prototypes of the device along with copies of the questionnaire were distributed to eight residential and public school programs and three rehabilitation facilities located throughout the country. Particular attention was given to exposing the enlarged abacus to very young visually handicapped students and those with additional involvements who experience difficulty using the Cranmer abacus. Mathematics teachers were asked to use the device with their students and record their reactions to

instructional sessions. The field evaluation was conducted over a period of six months but the majority of instructional programs completed the evaluation within a period of four to six weeks.

A total of 31 responses representing 11 educational programs were received. Table I shows the approximate percentage of responses which indicate the reaction of teachers to the usefulness of the enlarged abacus as an instructional tool. A majority of the teachers felt that the enlarged abacus was an effective instructional device and recommended that it be produced.

TABLE I
Teacher Response to Instructional Effectiveness
of Enlarged Abacus

Classes Taught	Positive	Neutral	Negative	Number of Responses
Multi-Handicapped	33%	33%	33%	3
Primary (K-2)	100%	-	-	6
Intermediate (3-5)	100%	-	-	7
Jr. High (6-8)	67%	33%	-	6
High School	75%	25%	-	4
Adults	100%	-	-	5
Percental Total*	84%	13%	3%	31

*Percent totals computed using the fractional number of total responses.

Percents rounded.

In addition to specific information related to the instructional effectiveness of the device, mathematics teachers provided general comments relevant to its use. Teachers indicated that the visually handicapped students who would benefit from using the device would be those with fine motor coordination problems, orthopedic handicaps, and low vision. The majority of teachers indicated the enlarged device would be beneficial at the primary level and could be used as an introductory aid for the Cranmer abacus facilitating transition to the smaller device because of the identical design. Several responses acknowledged that the enlarged device would be beneficial in teaching the fundamentals of abacus manipulation by training hand coordination using the larger device. Simultaneous instruction of groups using both the enlarged and the Cranmer device is possible. Teachers felt the advantages of the device are inherent in the larger beads, frame, and spaces between columns. They felt that students could easily distinguish and manipulate the beads and were provided ample room for resting the hands. One response indicated that more accurate work was produced by several students who used the device.

Several disadvantages were also noted by teachers. Visually handicapped students felt the larger device would not be as easy to carry as the Cranmer abacus. Slower work was produced by some, possibly a novelty effect was contributing to this factor. One response indicated students with perceptual problems had difficulty in distinguishing the rows of beads because of the similarity in shape and color.

Suggestions for changes in the device included rubber edges to withstand abuse and to prevent sliding on table tops, stronger beads, beads of different shapes and colors for easier visual perception, and providing enough tension on beads to prevent unwanted slippage.

Summary

Mathematics educators of the visually handicapped recommended the development of an abacus one third larger than the Cranmer abacus. The suggested target population that would use the enlarged abacus are young visually handicapped child consumers, those with additional involvements, and adults experiencing manipulation and discrimination problems. An evaluation was conducted which indicated that the majority of teachers who participated felt the enlarged abacus was a useful computational device and should be produced.

REFERENCES

- Brothers, R. J. Arithmetic computation by the blind; a look at current achievement. Unpublished report, American Printing House for the Blind, 1971.
- Franks, F. L. Institute report on instructional materials development in mathematics for visually handicapped. Unpublished report, American Printing House for the Blind, 1970.
- Lewis, M. Teaching arithmetic computation skills. Education of the Visually Handicapped, 1970, II, 66-72.

RESPONSES

<u>Schools and Agencies</u>	<u>Levels</u>	<u>Classification of Levels</u>	<u>Number of Responses</u>
Florida-Duval County Public Schools	Gr. 2 and 4	P and I	2
Kansas Rehabilitation Center	Adults	A	1
Overbrook School	Gr. 2 Gr. 2 Gr. 3 Gr. 4	P P I I	4
Peabody College	Multi-Handicapped (Adult)	A	1
Tennessee School	Gr. 1 and 2 Gr. 4 - Adult	P I, J, H, & A	5
Texas School	Multi-Handicapped (Gr. 1-4) Remedial Math. Gr. 2 Gr. 3 Jr. High	M M P I J	5
Utah School	Gr. 3 Gr. 7 Gr. 8 Jr. High	I J J J	4
Virginia School	Slow learners Gr. K, 1, & 2 Gr. 3, 5, 6, & 7	M P I and J	4
Western Pennsylvania School	High School High School High School	H H H	3
Arkansas Enter- prises for the Blind	Adults	A	1
Ky. Industries for the Blind	Adults	A	1

DATES OF ISSUE

1/25/71	Utah	Transported by Miss Hilda Caton
2/8/71	Western Pennsylvania School	Transported by Mr. Rick Baird
2/22/71	Overbrook School	Transported by Miss Hilda Caton
2/22/71	Georgia Academy	Sent to Mr. Frank Sconiers
2/22/71	Tennessee School	Sent to Miss Marian Lewis
2/22/71	Texas School	Sent to Mr. Daniel Kopecky
2/22/71	Virginia School	Sent to Dr. Robert Bruce
3/19/71	Florida--Duval County Public Schools	Sent to Miss Ann Henkel
3/23/71	Arkansas Enterprises	Sent to Mr. Roy Kumpe
4/7/71	Peabody College	Sent to Miss Suella McCrimmon
4/19/71	Kansas Rehabilitation Center	Sent to Miss Claudell Stoker
6/9/71	Kentucky Industries	Sent to Mr. Cox and Mrs. Houser

ENLARGED ABACUS--Field Evaluation

One recommendation from the Institute on Instructional Materials Development in Mathematics for Visually Handicapped students held at the American Printing House for the Blind, Louisville, Kentucky, April, 1970 called for design of an abacus one-third larger than the Cranmer Abacus. The need for the large abacus was suggested for use by young blind students and others who lack the manipulative skill required for easy manipulation of the small device.

Prototypes of the larger abacus are being distributed to educators over the country for critical evaluation. Particular attention should be given to exposing the enlarged abacus to very young blind children and those with additional involvements who experience difficulty using the Cranmer abacus. Please indicate any suggestions you have for modifying the prototype*, comments regarding its use with children, and recommendations for production on the following sheet.

* If the enlarged abacus is produced, it will be constructed of material similar to the Cranmer abacus.

School _____

Teacher _____

Date _____

- 1) What percent of your students have difficulty manipulating the Cranmer abacus?

Grade Level _____ Percent

- 2) What is the nature of the difficulty?

- a) Size of beads too small to manipulate
- b) Columns too close to discriminate
- c) Unit too small to manipulate with ease.
- d) Describe other problems that cause difficulties in using the Cranmer abacus.

- 3) What percentage of the students find the primary abacus more helpful than the Cranmer abacus?

- 4) What characteristics of the primary abacus make it a useful learning device?

5) Were computational activities easier to perform using the primary abacus?

6) Is there sufficient need for an enlarged abacus to warrant APH production in addition to the Cranmer abacus now available?

7) Other comments which support or oppose production of the primary abacus can be written below.

